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THE ALISO WATER MANAGEMENT AGENCY
STUDY: AN INVESTIGATION OF SELECTED
SEWAGE TREATMENT FACILITIES IN ORANGE
COUNTY

Environmental Protection Agency
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Section 1 - INTRODUCTION

As requested by Air and Water Programs Division, in a memo dated 20 April 1973, the Surveillance and Analysis Division conducted inspections of five wastewater treatment plants in southern Orange County. The purpose of these inspections was to obtain information on the status of the existing sewerage systems in order to prepare an objective evaluation of a proposal by Aliso Water Management Agency (AWMA) to expand and/or modify the existing system.

Scope

The treatment plants surveyed included the Moulton-Niguel Plants 1A and 2A, the South Laguna Plant and the Los Alisos Plant. Additionally, the Moulton-Niguel Plant 3A was inspected because it is part of the Moulton-Niguel system and until recently had discharged into the South Laguna system. The investigation, conducted between 10 May 1973 and 23 May 1973, was limited to the review of available data and inspection of the facilities.

Objectives

The objectives of the study were to:

1. Determine if design deficiencies are present and assess their effect.
2. Evaluate operation and maintenance of the treatment plants and recommend areas of change.
3. Evaluate the present interplant system.

Acknowledgments

The investigation was conducted by James R. Jones and Daryl G. DeRuiter, both sanitary engineers in the Technical Support Branch, Surveillance and Analysis Division.

Section 2 - EXISTING REGIONAL SYSTEM

The AWMA District encompasses approximately 23,080 ha (57,000 acres) situated along the Pacific coast in southern Orange County. The primary entities of the district are: the Moulton-Niguel Water District, the Irvine Ranch Water District, the Los Alisos Water District, the City of Laguna Beach, the South Laguna Sanitary District and the El Toro Water District (Figure I).

The El Toro Water District and the Los Alisos Water District are self-contained entities having their own wastewater treatment plants. Effluent is reclaimed for use on nearby agricultural or recreational lands. The City of Laguna Beach and the South Laguna Sanitation District treat wastewater at their respective plants and discharge to the ocean.

The 1A Plant and the 2A Plant of Moulton-Niguel have been intermittently treating a portion of the flow from the Moulton-Niguel Water District, with the remainder discharged to the Alisos Creek Interceptor Sewer and treated at the South Laguna Treatment Plant. The intermittent operation of the two plants, in addition to discharges of sludge and the draining of ponds to sewer, has significantly affected the operation of the South Laguna Plant.

The Moulton-Niguel Plant 3A, located in the Southeast Regional Reclamation Authority District (SERRA) is equipped to treat a portion of the flow from the Moulton-Niguel Water District No. 3. The treated effluent is used on an adjacent golf course, while excess flow and solids are discharged to the Oso-Trubuco Creek Interceptor and treated at the SERRA Plant.

The California Regional Water Quality Control Board, San Diego Region, in a letter dated 22 November 1972, ordered that effluent from Plants 1A and 3A not be used for golf course irrigation until bacteriological requirements are met. State Department of Public Health standards require reclaimed wastewater used for landscape irrigation to maintain a median Most Probable Number of coliform organism at less than 23 per 100 milliliters. In addition to not meeting this requirement, the Board noted "large quantities of suspended solids" as well as "lack of operational care" at both plants. (See Appendix I.)

In addition to bacterial requirements, the State Board requires that BOD and suspended solids in discharge from Plant 1A intended for irrigation not exceed 30 mg/l in a 24-hour composite or 40 mg/l in a grab sample (Order No. 71-61). At Plant 3A and 2A, the annual average BOD shall not exceed 30 mg/l (Resolution 64-R19 and Resolution 64-R20).

Section 3 - MOULTON-NIGUEL WATER DISTRICT

The Moulton-Niguel Water District owns and operates three wastewater treatment plants; Plant 1A, Plant 2A, and Plant 3A. The design of the plants is similar in that each incorporates the "Rapid Bloc" system of treatment which is system patented by Chicago Pump and incorporated into the plant design by Boyle Engineering. The following section discusses the "Rapid Bloc" concept in more detail. A description and review of each of the three plants is also given with individual differences noted.

The same person supervises the operations of all three plants. One operator is assigned to each plant and their work weeks are staggered so that, with the exception of one day, two operators are available to operate the three plants. Back-up personnel are not available in case of sick leave or vacation leave. Depending upon work loads, an operator may be assigned to another plant or may be requested to "cover" another operator.

The three operators are certified by the California Water Pollution Control Federation, two as Grade 3 and one as a Grade 4. During the inspection, it was noted that more personnel are required to operate and maintain the plant as well as maintain the grounds in a satisfactory manner. For an activated sludge plant of the size of the three plants combined, normal plant manpower requirements would require about seven people. This total would be the bare minimum for the three plants. (See Black & Veatch Report, EPA No. 17090 DAN 10/71.)

The laboratory has been certified by the California Department of Public Health for bacteriological and partial chemical analysis. The laboratory technician, certified as a Class 4 operator, appears quite capable of performing the laboratory analyses required for each plant, however, the lack of operators limits the sampling program as well as its effectiveness in developing an in-plant control program.

A cursory evaluation of the 1971-72 actual expenditures for plant operations and maintenance indicates higher than normal operating costs. Costs, based upon design capacity,

were approximately \$0.073/cu m (\$275/mil gal) for Plant 1A, \$0.66/cu m (\$250/mil gal) for Plant 2A, and \$0.20/cu m (\$750/mil gal) for Plant 3A. The treatment cost at design flow for Plants 1A and 2A are in the normal range for treatment plants of this size and type. Costs for Plant 3A are about three times greater than what would be expected. (See Black & Veatch Report, EPA No. 17090 DAN 10/71.) The actual cost per unit flow treated was two or three times greater than the above costs due to reduced flow through the plant.

"Rapid Bloc" System

The "Rapid Bloc" system is a modification of the activated sludge process. Chicago Pump Corporation, proprietary owner of the system, claims that with their system the contact time of sludge with food and oxygen is 95 percent of the detention time and that this allows use of smaller aeration facilities with high treatment efficiencies. The designers of the three plants in the Moulton-Niguel Water District incorporated the "Rapid Bloc" system and used parameters which are much higher than those for any other activated sludge process. Their rationale for the designs is, however, questionable in light of operational problems encountered at these plants.

The major problem associated with the operation of the "Rapid Bloc" system is the lack of control of the in-plant operations. This problem has been compounded by high daily flow fluctuations at all three plants and the inability to control or measure flow through the plants. At present, the amount of flow or solids returned from the settling tanks is unknown. Attempts to control the return by varying air injection or by shutting off the return flow chimney would be difficult. There are no automatic controls or metering devices on the air injection for either the aeration tank diffusor or the air jets in the return sludge chimney. Therefore, air in the aeration tank is constant and cannot be varied to accomodate the daily fluctuation in waste load strength. This results in too great an air flow during night time and not enough flow at periods of peak loading during the day.

There is some question as to the actual design capacity of the "Rapid Bloc" system. The design loadings for the individual units may be compared to those normally found in a conventional activated sludge plant which has much greater

controls. Using Plant 3A as an example and assuming 1892.5 cu m/day (0.5 mgd), the organic loading in the "Rapid Bloc" system would be 2020 g BOD/cu m/day (125 lbs BOD/1000 cu ft/day). This is much higher than the recommended loading for conventional activated-sludge plants of 320 to 720 g BOD cu m/day (20 to 40 lbs BOD/1000 cu ft/day) or for step-aeration activated sludge of 720 to 960 g BOD/cu m (40 to 60 lbs BOD/1000 cu ft). The detention time in the aeration tank of the "Rapid Bloc" design is 3 hours and represents the lower limit for such a process.

In the settling tank, the surface loading is 29.0 cu m/day/sq m (710 gal/day/sq ft) and the volumetric loading is 8180 l/day/cu m (60.6 gal/day/cu ft). These loadings are comparable to standard secondary sedimentation units. Additionally, the lack of a primary clarifier with grease and scum control, a unit found in most treatment plants, places added pressure on the "Rapid Bloc" unit.

Because of the apparent overloading and lack of primary clarifier, it appears that the "Rapid Bloc" unit cannot operate consistently at the design flow. This is a hybrid activated sludge system which should require greater control of operational parameters than activated sludge but in actuality, has less. The high daily fluctuation in wastewater flow and strengths would necessitate even more plant controls. In order to provide consistent high levels of treatment with the existing system, flows may have to be reduced to as little as 50 percent of design flow. For this size plant, the economy of continued operations would appear questionable and deserves further evaluation.

Moulton-Niguel Plant 1A

The Moulton-Niguel Water District No. 1 has (as of March 1973) 2027 sewer connections. Assuming 3.7 persons per unit in this predominately residential area, the population is approximately 7500. The plant was built in 1963 and designed by Boyle Engineering to handle 1890 cu m/day (0.5 mgd), or a population equivalent of 6750.

The plant draws a capacity load of wastewater for treatment from the trunk sewer and bypasses any remaining effluent via the Aliso Creek Interceptor to the South Laguna Sewage Treatment Plant. Because of restrictions imposed by the

California Regional Water Quality Control Board, San Diego Region (see Appendix I), the plant effluent cannot presently be used as reclaimed water for irrigation and is being discharged to the Interceptor. The operations of this plant have been irregular with long periods of plant inactivity. It has only recently been restarted after shutting down in January 1973.

Components of Plant 1A include a Barminutor, aerated grit removal system, and a "Rapid Bloc" system. The plant effluent is discharged to four oxidation ponds, and chlorination facilities are provided both before and after ponding. A schematic of the plant is shown in Figure 2.

The headworks include the influent structure, a Barminutor, a bypass bar screen and a Parshall flume. These were in satisfactory condition at the time of the inspection. The Barminutor's capacity is 9460 cu m/day (2.5 mgd) and the remainder of the headworks appears to have been designed for expansion in four stages to 7570 cu m/day (2.0 mgd). The wastewater then flows to a junction box, which was ultimately designed to split the flow after expansion of the facility was affected. From there, the flow goes on to the "Rapid Bloc" unit.

The "Rapid Bloc" facility is similar to the other systems in the District and consists of an activated sludge aeration tank, a final settling tank and an aerobic digester for treatment of the sludge. The unit is slightly modified in that two aeration units have been backed-up together, with the common wall removed and settling tanks constructed on each side.

The flow coming from one aeration to two settling tanks creates problems of equalizing flow to the settling tanks. As at Plant 3A, air jets were installed to facilitate flow of return sludge up the chimney and back to the aerated tank. However, the capacity of the air compressor is insufficient to supply both the air diffuser tubes and the air jets in the chimney. At this time, air is only being supplied to the air jets.

The operator attempts to maintain settleable solids at 200 ml/l in the aeration tank by adjusting the amount of sludge wasted from the settling tank. During January 1973,

at a treatment flow of about 570 cu m/day (0.15 mgd), the suspended solids and BOD in the "Rapid Bloc" unit effluent both averaged about 10 mg/l. According to the operators, the plant has not been able to consistently maintain satisfactory treatment levels at wastewater flows much greater than the 570 cu m/day.

After chlorination, the "Rapid Bloc" effluent flows to four oxidation ponds which have been modified to operate in series. Their area totals 20.97 ha (4.66 ac) and volume is 24,500 cu m (19.86 ac ft). At a design capacity of 1890 cu m/day (0.5 mgd), the detention time would be 12.9 days. The actual flows do not approach the design flows so that detention time is lengthened proportionally. At the time of the inspection, effluent with a heavy algal growth was being discharged to the interceptor sewer.

Moulton-Niguel Plant 2A

The Moulton-Niguel Water District No. 2 has (as of March 1973) 889 sewer connections. Assuming 3.7 persons per unit in this predominately residential area, the population served is approximately 3,300. The plant was designed to handle 1325 cu m/day (0.35 mgd) or a population equivalent of 3,500 persons. The plant has been shut down in the past for extended periods due to unit failures when operational treatment efficiencies were not consistent. The portion of wastewater not treated by the plant as well as overflow from the oxidation ponds flows down the interceptor to the South Laguna Sewage Treatment Plant.

Components of Plant 2A include an aerated grit removal system, a "Rapid Bloc" system with aeration, settling and anaerobic digester units, sludge drying beds, a series of four oxidation ponds, and chlorine contact tank. A schematic of the plant is shown in Figure 3.

The headworks include the influent structure, a magnetic flow meter and the aerated grit chamber with grit washer. These appeared to be operated and maintained in a satisfactory manner at the time of the visit. Noticeably lacking, however, was a comminuting device or sufficient screening to remove coarse material. This, coupled with the absence of primary clarification, significantly increased the loading on the activated sludge unit.

The "Rapid Bloc" system is similar to the other systems operated by the District. The plant was designed for 1325 cu m/day (0.35 mgd) although operators report that it cannot function effectively at flows much greater than 380 cu m/day (0.1 mgd). At the time of the inspection, a great deal of foam and solids were observed floating in each unit. A large portion of these was in the form of grease balls or other solids normally removed by primary units. The foam appeared to be of cellular origin and resembled the type commonly found in activated sludge units. It was, however, darker than normal, indicating either "old sludge" or too long a "mean cell retention time." This indicates an operational problem, which is difficult to control in a plant of this type.

The effluent from the "Rapid Bloc" system flows by gravity to the oxidation ponds. The first two ponds are operated in parallel. The wastewater then flows through two other ponds in series. During the time of the visit, the first two ponds were septic with some associated odor problems, while the others contained good algal growths. At the far end of the final pond is a chlorine contact chamber which is not, and apparently had never been, used. The chlorinators are no longer at the site.

Moulton-Niguel Plant 3A

The Moulton-Niguel Water District No. 3 has (as of March 1973) 6525 sewer connections. Assuming 3.7 persons per unit in this predominately residential area, the population is approximately 24,100. The Moulton-Niguel Plant 3A is capable of treating only a small portion of the flow originating from this area, with the remainder flowing down the Oso-Trubuco Interceptor to the SERRA Plant. The plant effluent would normally be mixed with MWD water to irrigate the Mission Viejo Golf Course but is now discharged back to the Interceptor because of restrictions imposed by the California Regional Water Quality Control Board, San Diego Region (see Appendix I).

Influent wastewater is pumped from the interceptor sewer by one of the two 2.84 cu m/min (750 gal/min) pumps located in the pump well. The wastewater then flows by gravity through a Barminutor, an aerated grit removal system, and "Rapid Bloc" activated sludge unit to the chlorine contact chamber. From the contact chamber, the effluent can be pumped directly either from the plant or through pressurized sand filters before discharge. Figure 4 shows a schematic of the plant.

The 3A Plant was the first of the three plants built by Moulton-Niguel using the "Rapid Bloc" unit concept. It was designed for 1890 cu m/day (0.5 mgd) and during its early years of relatively low flows was able to achieve fairly good treatment. As the flow increased, the lack of controls specifically within the "Rapid Bloc" unit have seriously affected the plant's treatment efficiencies. The flows treated have fluctuated between about 560 cu m/day and 1320 cu m/day (0.15 mgd to 0.35 mgd) because of maintenance problems experienced within the plant. The ability to control and measure the flow is suspected to contribute to this condition.

The Barminutor was out of operation at the time of the inspection and a replacement part had been ordered. Consequently, the flow was diverted to a bypass bar screen. This was followed by a Parshall flume, without a depth recorder. The aerated grit removal system was operating in a satisfactory manner, with grit removed from the aerated tank by means of inclined grit washer and disposed of on the site.

The "Rapid Bloc" activated sludge unit has been modified from the original design. Rather than using one of the tanks of the unit as an aerobic digester, one wall had been removed to combine the digester with a portion of the aerated tank to form a large "pre-aeration" tank where scum and sludge from the clarifier unit are returned. This tank acts in some respects as a surge tank to even out highly fluctuating daily flows.

The design of the aeration tank is similar to the standard activated sludge aeration unit. The clarifier is 4.88 m (15 ft) deep with the settling solids concentrated in a 55 degree-sloped hopper bottom. As designed, sludge was to return to the aeration tank through a chimney where an updraft or suction is formed by the circulation of flow in the aeration tank. In practice, this sludge return system did not work and it was necessary to install air jets in the chimneys to facilitate an upflow regime. As a result, the return sludge is not as concentrated as would be required in a normal activated sludge process. On the other hand, it is theoretically recycled more quickly and therefore allows the organisms to maintain contact with food for a greater percentage of time.

Over the past several months, the mode of operation of the "Rapid Bloc" unit has often been changed to obtain desired treatment. In April 1973, the operator tried to maintain settleable solids of 200 ml/l in the aeration tank by varying the amount of sludge wasted. At this point, removals were quite good with effluent BOD and TSS generally running less than 30 mg/l; however, the flow was usually less than 750 cu m/day (0.2 mgd). In May, the operational mode was changed in an attempt to maintain a "5-day cell retention." Instead of calculating the retention time using solids data, unit volumes were used which resulted in false indication of unit operation. Wasting of solids must be accomplished manually by pumping the desired amount from the settling tank to the Interceptor. At the time of the inspection, the treated flow was thought to be 1325 cu m/day (0.35 mgd), so that 150 cu m/day (0.040 mgd) was wasted each morning. High concentration of solids were noted during visual observations of the effluent and indicated poor treatment.

Chlorination of the "Rapid Bloc" effluent is obtained by the chlorine contact chamber. No automatic controls for chlorine dosage are available at Plant 3A and dosage was set to maintain a residual minimum of 15 mg/l. At time of low flow, the dosage was excessive with resultant chlorine odor and inefficiency. The rationale for placing the sand filters behind the chlorination unit is questionable; filtering the wastewater before chlorination would definitely reduce the chlorine requirements.

Section 4 - LOS ALISOS WASTEWATER TREATMENT PLANT

The Los Alisos Wastewater Treatment Plant is owned by the Los Alisos Water District and was initially constructed in 1964 to treat 1890 cu m/day (0.5 mgd). In 1972, it was modified and expanded to treat 3785 cu m/day (1.0 mgd). Currently, the plant serves about 2,000 sewer connections with an average flow of 3030 cu m/day (0.8 mgd).

The plant incorporates the "Rapid Bloc" system modified to alleviate some of the problems encountered in other plants. Basically, the plant consists of a distribution box, Barminutor, aerated grit removal system, Parshall flume, and the "Rapid Bloc" system made up of an aeration tank, clarifier and aerobic digester. Following the "Rapid Bloc" system, the treated water then flows through two oxidation ponds and passes through a chlorine contact chamber before being discharged to Irvine Ranch property for irrigation of agricultural lands. Figure 5 shows a schematic of the plant.

The components of the headworks were designed for 7570 cu m/day (2.0 mgd) to handle future enlargements. Due to operational problems with the original barminutor, a new comminutor was recently installed in the existing parallel channel, with the barminutor now in use as a backup unit. The aerated grit removal system and associated grit wash systems were operating satisfactorily during the inspection. In conjunction to the aerated grit chamber, a scum box was installed during the reconstruction period. It has apparently reduced grease in the "Rapid Bloc" unit. As the effluent leaves the headworks, it flows through a Parshall flume. The existing flow measuring unit has been unreliable and a new level recorder has been ordered as a replacement.

The "Rapid Bloc" system is similar to the units operated by Moulton-Niguel but has been modified after construction to improve efficiency. A "Travalift" system, an airlift system patented by Chicago Pump Company, was installed in the clarifiers to recycle sludge from the hoppers to the aeration unit. With it, sludge return and sludge wasting can be controlled better with resultant increases in efficiency at higher flows.

Even with the several modifications undertaken, some questions remain as to the actual design capacity of the plant. The organic loading, comparable to the Moulton-Niguel plants, is 2155 g BOD/cu m/day (134.6 lbs/1000 cu ft/day). This is higher than the recommended level for conventional activated sludge of 320 to 720 g BOD/cu m/day (20 to 40 lbs BOD/1000 cu ft/day). The detention time at 3785 cu m/day is 2.6 hours, a period considered definitely low for any activated sludge process. With respect to the final clarifier, the surface loading of 23.2 cu m/day (570 gal/ft²/day) and volumetric loading of 9020 l/day cu m (66.8 gal/day/cu ft) are comparable to standard clarification units. Overall, there are still deficiencies. Even though the "Rapid Bloc" design has been improved, it is unlikely in light of the above discussion, that the plant will be able to operate at design flow and produce a consistently high quality effluent.

The effluent from the "Rapid Bloc" unit flows to the two oxidation ponds, with a total surface area of some 2.1 ha (5.1 ac) and a total volume of 50,300 cu m (40.8 ac ft). There is, at a 3785 cu m/day flow, a theoretical detention time of 13.3 days. At present, effluent flows from Pond 1 and into Pond 2 before discharge for irrigation purposes. In the near future, this process will be reversed. A channel will return the flow from Pond 2 to the south end of Pond 1 and the effluent will discharge at the north end of Pond 1. Additionally, six surface aerators, three in Pond 2 and three in the southern end of Pond 1, will be installed to increase plant capacity.

During the past year, the plant has undergone a period of transition with new modifications and a new chief operator. The present operator has been hard-pressed to operate and maintain the plant in a satisfactory manner as well as maintain records and laboratory controls. The district, however, is in the process of hiring three new certified operators. This should make a substantial difference in operation efficiency and maintenance.

Section 5 - SOUTH LAGUNA SANITARY DISTRICT

In 1966, Boyle Engineering conducted an investigation of sewerage facilities for the South Laguna Sanitary District (SLSD). Population projection for the area indicated that treatment facilities of 12,110 cu m/day (3.2 mgd) capacity would be needed by the year 2010. Immediate steps were taken to initially construct a plant of 6055 cu m/day (1.6 mgd) capacity, with provisions made to expand to 12,110 cu m/day (3.2 mgd) capacity around the year 1980. By the fall of 1969, a 6055 cu m/day (1.6 mgd) plant was constructed and in operation. It replaced the two existing Imhoff tanks of 1968 cu m/day (0.52 mgd) capacity which previously served the City of South Laguna.

Rapid growth in the Moulton-Niquel Water District (MNWD) prompted directors of the district to enter into an agreement to construct a second increment of 6055 cu m/day (1.6 mgd) capacity. The MNWD is allowed to deliver flow to the site in an amount not exceeding the capacity which is not utilized by the SLSD for its flows. Additions to bring the capacity of the plant to 12,110 cu m/day (3.2 mgd) were constructed and completed by December 1969.

The South Laguna Plant presently receives wastewater from the Moulton-Niquel Plants 1A and 2A in addition to municipal wastewaters from the City of South Laguna. Wastewater flows from the Moulton-Niquel plants include: excess raw sewage from the MNWD that Plants 1A and 2A are unable to treat; waste sludge flows; treated effluent from Plant 1A during periods when its effluent is not used for irrigation; and occasionally water from the stabilization ponds at Plant 2A during periods when these ponds are drained.

Wastewaters from South Laguna enter the plant via an unmetered force main from the Alisos Creek Pumping Station. The Moulton-Niquel wastewaters enter the plant via a separate force main which is equipped with a magnetic flow meter and recorder. The South Laguna influent flows are obtained by computing the difference between the Moulton-Niquel flow and the total plant effluent flow which is measured and recorded by a V-notch weir located at the discharge of the chlorine contact chamber. A schematic of the plant is shown in Figure 6.

The influent wastewaters pass through a Barminutor prior to the pre-aeration tank. Grit from the pre-aeration tank is pumped to a grit washer and screw-type grit removal apparatus by means of two airlift pumps. Excessive turbulence in the grit washer due to the location of the influent greatly reduces the efficiency of this unit. No grease removal equipment is provided in the pre-aeration tank.

The wastewater then enters one of two primary sedimentation basins operated in parallel and equipped with corrugated aluminum covers. These covers were added because the blower building is located adjacent to the primary sedimentation tanks, and it was believed that gases emitting from these tanks were being drawn into the intake of the blower system and causing corrosion to the equipment. A chain-flight scrapes the settled solids along the tank bottom to the inlet end of the tanks and into the sludge hoppers. Grease and other floatables are delivered to a manual skimmer near the outlet end of the tanks by the same flights on their return cycle. Skimmings flow by gravity through a pipe to a sludge disposal hopper where they are combined with other primary sludge and waste activated sludge for further treatment. At design flow, the surface overflow rate is 40.8 cu m/day/sq m (1000 gpd/sq ft); the weir overflow rate is 549 cu m/day/m (44,300 gpd/ft); and the hydraulic detention time is 1.48 hours. At the time of the visit the primary sedimentation tanks appeared to be performing quite satisfactorily.

Each primary tank has two hoppers. Each hopper has a sludge draw-off pipe which connects to the pump suction through a valve system. Transparent sight glasses are provided in the suction piping to allow visual observation of the consistency and density of the sludge. The sludge is pumped to the sludge disposal hopper by means of two Dorr-Oliver positive displacement plunger pumps.

The primary effluent flows into the aeration tank - mixed liquor system. This system consists of three tanks, of 1298 cu m (343,000 gal) each, which are situated in a parallel arrangement. These tanks may be operated in a parallel or series flow pattern and with conventional, step, or contact stabilization type of loading. Presently, the first two tanks are utilized in a parallel operation with step loading. The third tank is being used temporarily as an aerobic digester. The only controls applied to the mixed liquor system are the suspended

solids concentration (2500 mg/l) and the dissolved oxygen (1.5 - 2.0 mg/l). The mixed liquor concentration is controlled by adjusting the return sludge rate. Three 56 cu m/min (2000 cfm) single-speed blowers provide air to the system. One of these blowers is used to aerate the aerobic digester. There is no control on the air except for a bleedoff valve.

Mixed liquor from the aeration tanks discharges into a channel. From there it is distributed into four rectangular secondary clarifiers. Each clarifier is equipped with two inlet slide gates which are manually set. Because of the non-symmetrical layout of this flow pattern, equalization of flow to the four clarifiers may present a problem. A chain-flight collector scrapes the settled sludge into two V-shaped hoppers at the effluent end of each tank. The sludge is then removed by two telescopic valves in each tank. From the telescopic valve discharge, the sludge flows by gravity to the return sludge well. From this well, the sludge may be pumped to the head-end of the aeration tanks or into the sludge disposal hopper. Floatables in the secondary clarifiers are delivered to the inlet end of the clarifiers via water surface sprays and are removed by floating pad skimmers. Each clarifier has a detention time of 2.17 hours (neglecting return sludge flow). The surface overflow rate at design flow is 32 cu m/day/sq m (784 gpd/sq ft) and the weir overflow rate is 122.5 cu m/day/m (9880 gpd/ft). The overflow launders are closely spaced and cover only a relatively small portion of the clarifier surface area, resulting in a much higher surface overflow rate than the numerical values indicated. Also, the surface of the clarifier immediately above the sludge collection hoppers is completely enclosed. No provision has been made to remove scum that might accumulate in this area. The clarifier effluent passes through a chlorine contact chamber with a design flow detention time of 25.4 minutes before ultimate discharge to the Pacific Ocean.

As indicated previously, the return sludge rate is determined by the desired mixed liquor concentration in the aeration tanks. The excess sludge is wasted to the sludge disposal hopper.

Sludge handling facilities consist of two gravity thickeners, one Imhoff tank converted to an aerobic digester, one Imhoff tank for storage of excess sludge, a Purifax unit for chlorinating sludge, and a series of sludge drying beds. A sludge incinerator was initially installed, but was later

removed because of corrosion problems. During normal operation, sludge is pumped from the sludge disposal hopper to the thickeners, with the thickened sludge being sent to the Purifax unit or to the aerobic digester. Sludge from the digester is returned to one of the thickeners before being sent to the Purifax unit. The Purifax unit subjects the sludge to a high chlorine dose under pressure prior to discharge to the drying beds. The plant is equipped with a series of drying beds with an underdrain system. The capacity of these beds is frequently exceeded and reserve sludge drying beds across Alisos Creek are used to dry excess sludge.

The most significant operational problems of the South Laguna Plant result from the unorthodox and inadequate system of sludge handling. The aerated digester is approximately 8.4 meters (28 feet) deep. The supply of air and subsequent mixing in the tank is far from sufficient and solids accumulation in the bottom of the tank is inevitable. The Purifax unit has had a history of unreliability. The control system is housed in the same building as the chlorination equipment. A leak which occurred in one of the chlorine lines caused much corrosion of the contacts in the control box, resulting in a series of breakdowns.

The plant is adequately staffed with operators and maintenance personnel. Consequently, its condition and appearance were quite satisfactory. Fine-tuned control was lacking, however, but this is basically a matter of proper training. Unfortunately, the operation and maintenance manual provided by Boyle Engineering contained several erroneous techniques regarding the operation of an activated sludge plant. For example, sludge wasting rates for the secondary system were computed with consideration given only to the suspended solids entering the secondary system from the primary clarifiers. The sludge generated by conversion of soluble organics to biomass was completely ignored. The facility is also fortunate in having a well qualified, conscientious laboratory technician who could become quite an asset if fully utilized.

The quality of the effluent from the facility at the time of the visit was exceptionally good considering the appearance of the sludge in the system. The sludge in the aeration tank appeared quite dark for being an activated sludge. There may be several explanations for this condition: 1) septic sludge may arrive at this facility from the Moulton-Niguel system

upstream; 2) sludge may be retained in the final clarifiers too long; 3) cell-residence time may be excessive; or, 4) insufficiently aerated sludge from the sludge handling facilities may be returned to the activated sludge system.

Effluent monitoring was not adequate for a plant of this size (once per month for all parameters except coliform bacteria) but the data available indicated good BOD₅ removal. The effluent suspended solids, however, was somewhat erratic and frequently exceeded standards. High effluent suspended solids may be attributed to one of the following: 1) sludge flows reaching the headworks causing abnormally high overflow rates in the final clarifiers; 2) waste sludge from the Moulton-Niguel Plants 1A and 2A being discharged to this system; 3) high concentrations of pin flock escaping the final clarifiers; or, 4) bulking sludge. It is believed that BOD₅ is reduced significantly in the chlorine chamber, especially during periods of high suspended solids discharge.

It is believed that the performance of the South Laguna Treatment Plant is greatly affected by the nature, quantity, and frequency of discharges from the Moulton-Niguel plants. The practice of discharging waste sludges from these upstream plants into the sewer system should be terminated. South Laguna plant personnel indicated that they were seldom notified of any abnormal discharges to the system from the Moulton-Niguel plants. Complete communication between these two facilities is imperative, especially if the Moulton-Niguel District is permitted to discharge freely as they have in the past.

Section 6 - CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The Moulton-Niguel Water District's "Rapid Bloc" treatment plants are not capable of reliably treating wastewater flows at their design capacities. This is primarily due to the "Rapid Bloc" system design, itself, and attendant lack of control over operational parameters such as air use and solids control, and is aggravated by the lack of a sufficient number of operators to operate and maintain the plants in as optimum a manner as possible. The reduced capacity of the plants results in bypassing to downstream plants much of the sewage generated in the area.
2. The Los Alisos treatment plant, another "Rapid Bloc" design, was modified to overcome some of the problems experienced by the Moulton-Niguel Plants. Even with these modifications, the plant is not able to produce a good quality effluent at design capacity without utilizing the oxidation pond system which has been added as a polishing unit. This is primarily due to the "Rapid Bloc" system itself, which is more appropriate for constant inflow conditions than variable conditions where a great degree of operational control is needed.
3. The South Laguna Wastewater Treatment Plant has some design and operational problems, but is capable of producing adequate secondary treatment at design flows. Deficiencies were noted in the in-plant solids handling process. Variable discharges of waste sludge and/or effluents from the upstream Moulton-Niguel plants has had deleterious effects on the South Laguna treatment process.
4. Monitoring at the plants inspected was inadequate, both with respect to effluent quality monitoring (all plants) and that needed for in-plant operational control (all plants except South Laguna). This is especially true of the Moulton-Niguel plants. It is expected that the planned hiring of three more operators at the Los Alisos plant will eliminate the monitoring problem there. All of the Moulton-Niguel plants were also deficient in flow measurement capability, thus limiting operational control of the plant.

5. The Moulton-Niguel and South Laguna Plants are not operating efficiently as a system primarily due to a lack of communication between the plants. Data regarding discharge of solids and bypassing of wastewater, information which is necessary for efficient operation of the downstream South Laguna plant, is not forwarded by personnel operating the Moulton-Niguel plants. The lack of warning systems to report power outages or unit failures when the Moulton-Niguel plants are unattended also adversely affects operations.
6. On the basis of examination of records and operational performance, the Moulton-Niguel plants are not consistently meeting the requirements which have been placed on the quality of reclaimed wastewater necessary for use as irrigation water.

Recommendations

1. The Moulton-Niguel plants should not be included in a regional plan for wastewater treatment insofar as treatment capacity is concerned. The plants are presently capable of treating only a portion of the locally generated sewage flows, and with the population increases expected for the area, this portion will decrease percentage-wise. The plants could be utilized, during the season when reclaimed wastewater can be used for local irrigation, but the main downstream plant would still have to be designed to accommodate the entire flow in the region, since the upstream plants will not be able to dispose of effluent by irrigation year-round. If the sewage flows increase sufficiently to the point where the "Rapid Bloc" plants can operate on a steady-state constant flow condition, these plants should be able to produce an acceptable effluent, albeit at lower flows than original design. The economics of operating these plants versus the cost of alternate sources of water for irrigation would have to be determined.
2. Portions of the South Laguna plant might be used in an expanded regional plant system, but because of its location at the base of a hill, enlargement of the present plant appears to be unfeasible. Present operation would be enhanced by increasing the air capacity and modifying the solids handling system; the effluent monitoring frequency should also be increased.

3. In order to meet discharge requirements for water reclamation, the Moulton-Niguel Water District should take steps to alleviate many of the design and operational problems noted in the individual plant discussions. Of particular importance is the need for at least three more operators and a warning system for power outages and unit failures. All plants should have adequate flow measuring devices installed to monitor both unit process flows and the volume of effluent treated. Provisions for variable air flow control and measurement should be provided. The monitoring (sampling frequency and analyses) program should be strengthened to allow better operational control.
4. An institutional agreement to operate the Moulton-Niguel 1A and 2A plants and the South Laguna plant under one superintendent should be considered. As a minimum for the interim, a communications system should be arranged between the Moulton-Niguel and South Laguna plants such that the operators of the latter have knowledge of the upstream plants operational modes. Included should be sufficient advance warning of changes expected so that the South Laguna plant can be readied to accomodate such changes.

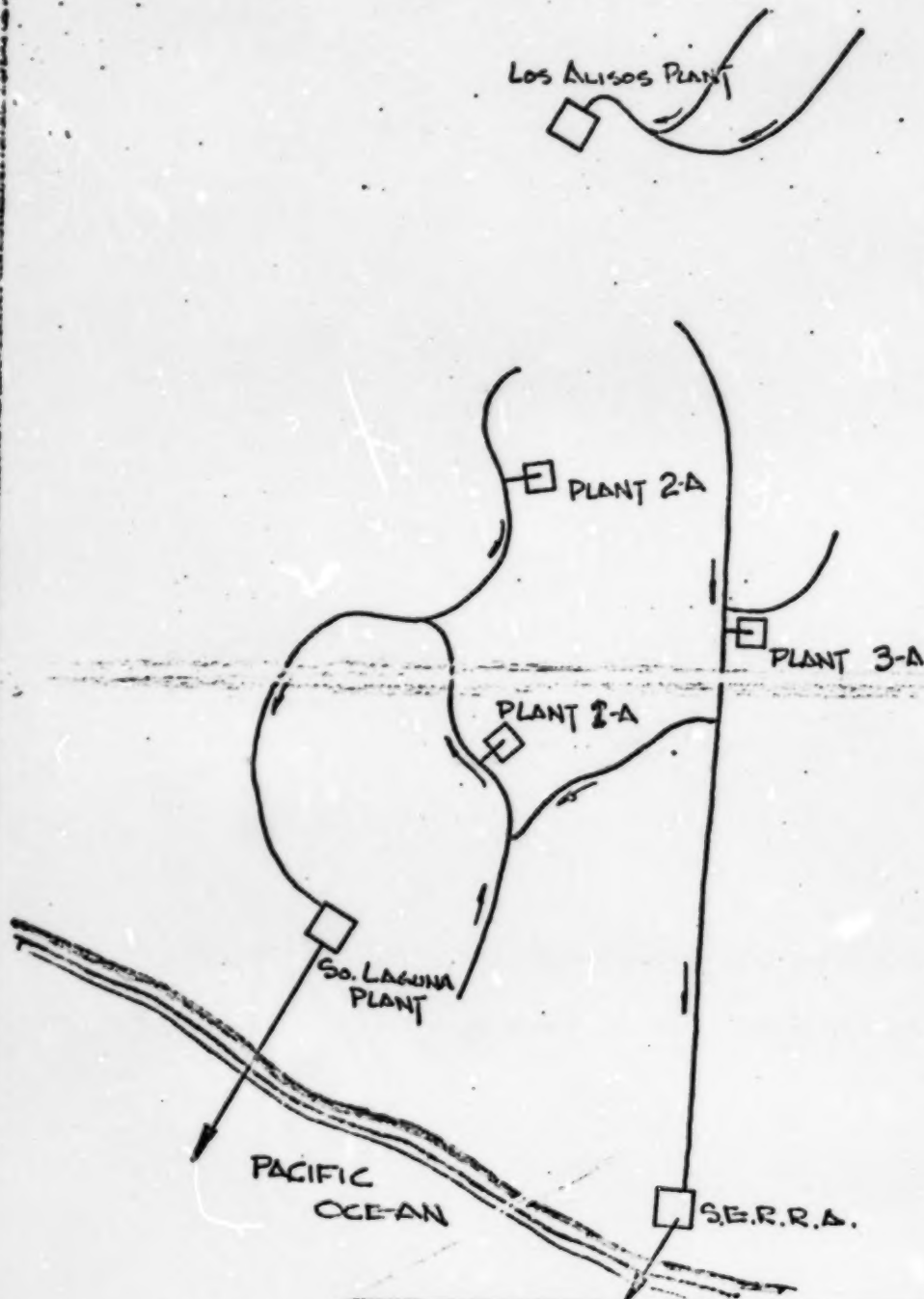
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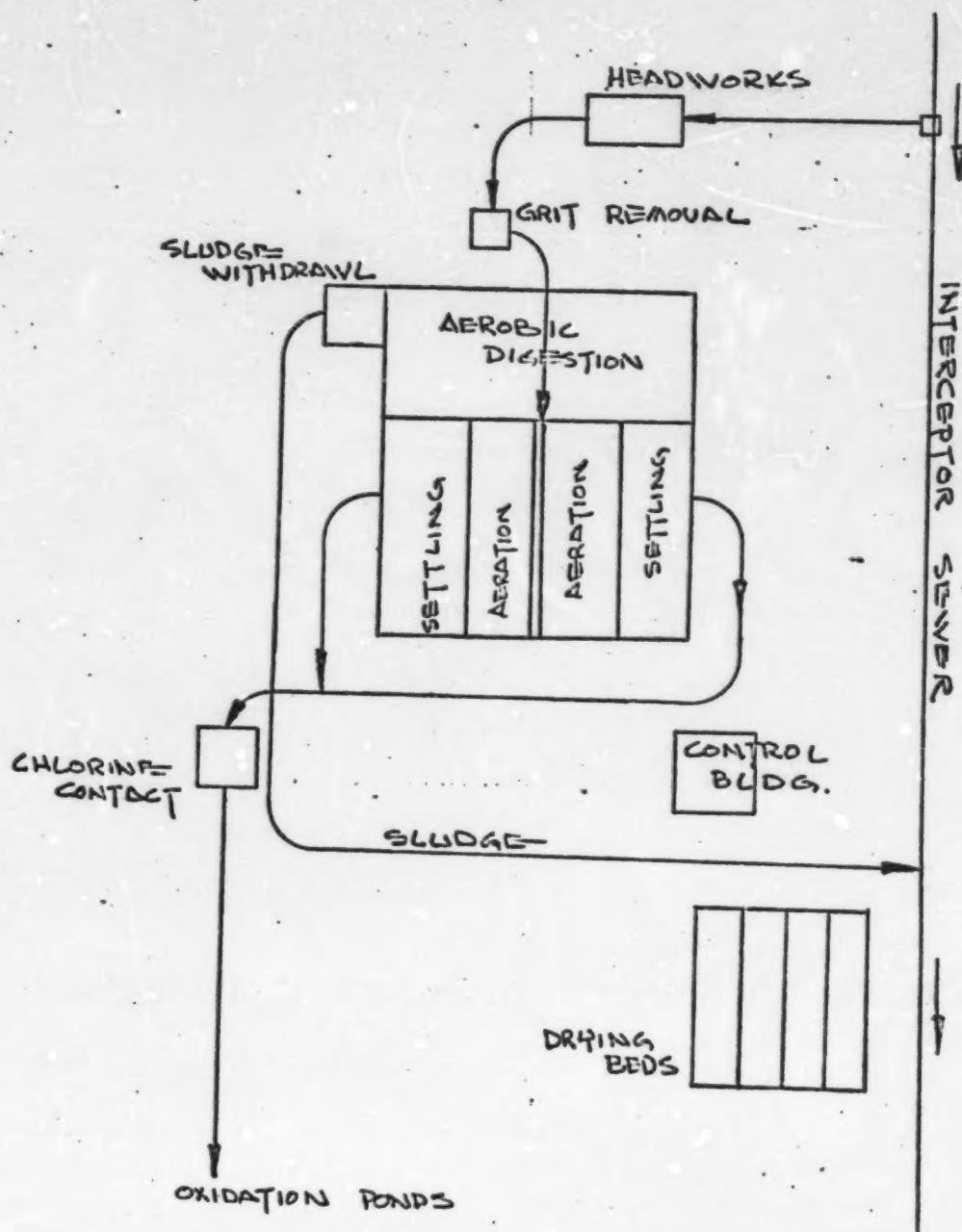
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ALISO WATER
MANAGEMENT DISTRICT



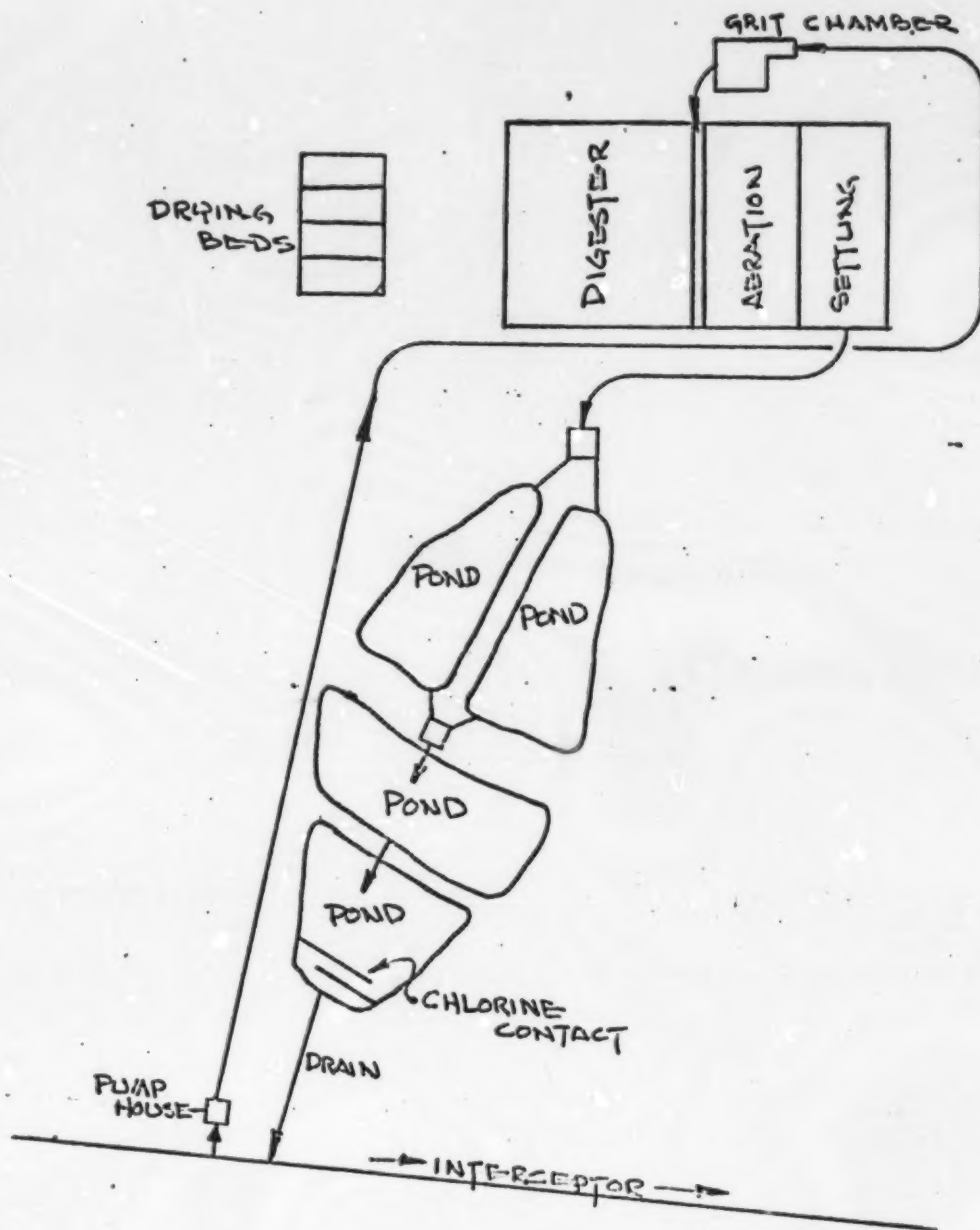
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MOULTON-NIGUEL WATER DISTRICT
PLANT 1-A

Figure No. 2

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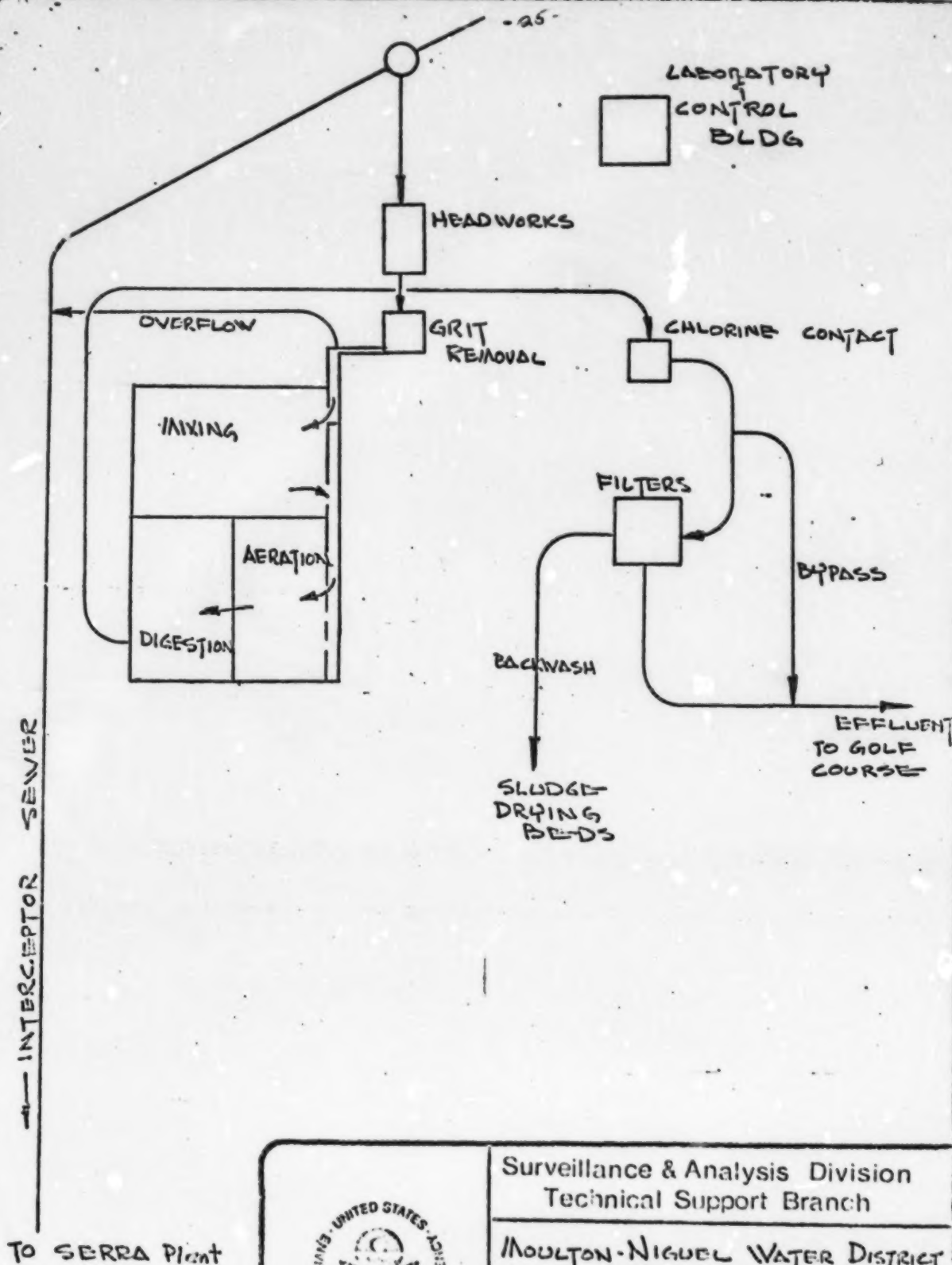
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MOULTON-NIGUEL WATER DISTRICT
PLANT 2-A

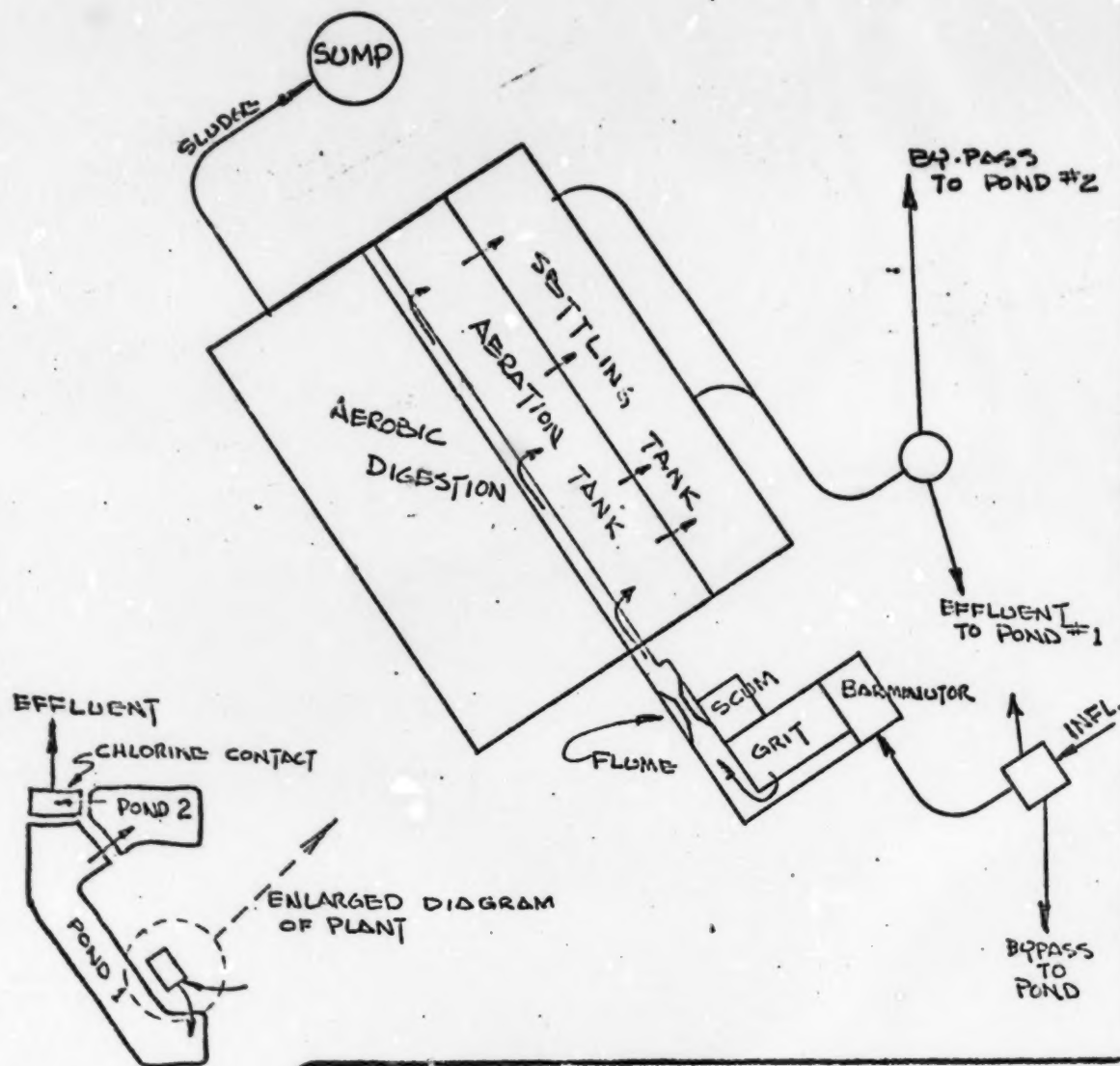
Figure No. 3



Surveillance & Analysis Division
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MOULTON-NIGUEL WATER DISTRICT
PLANT 3-A

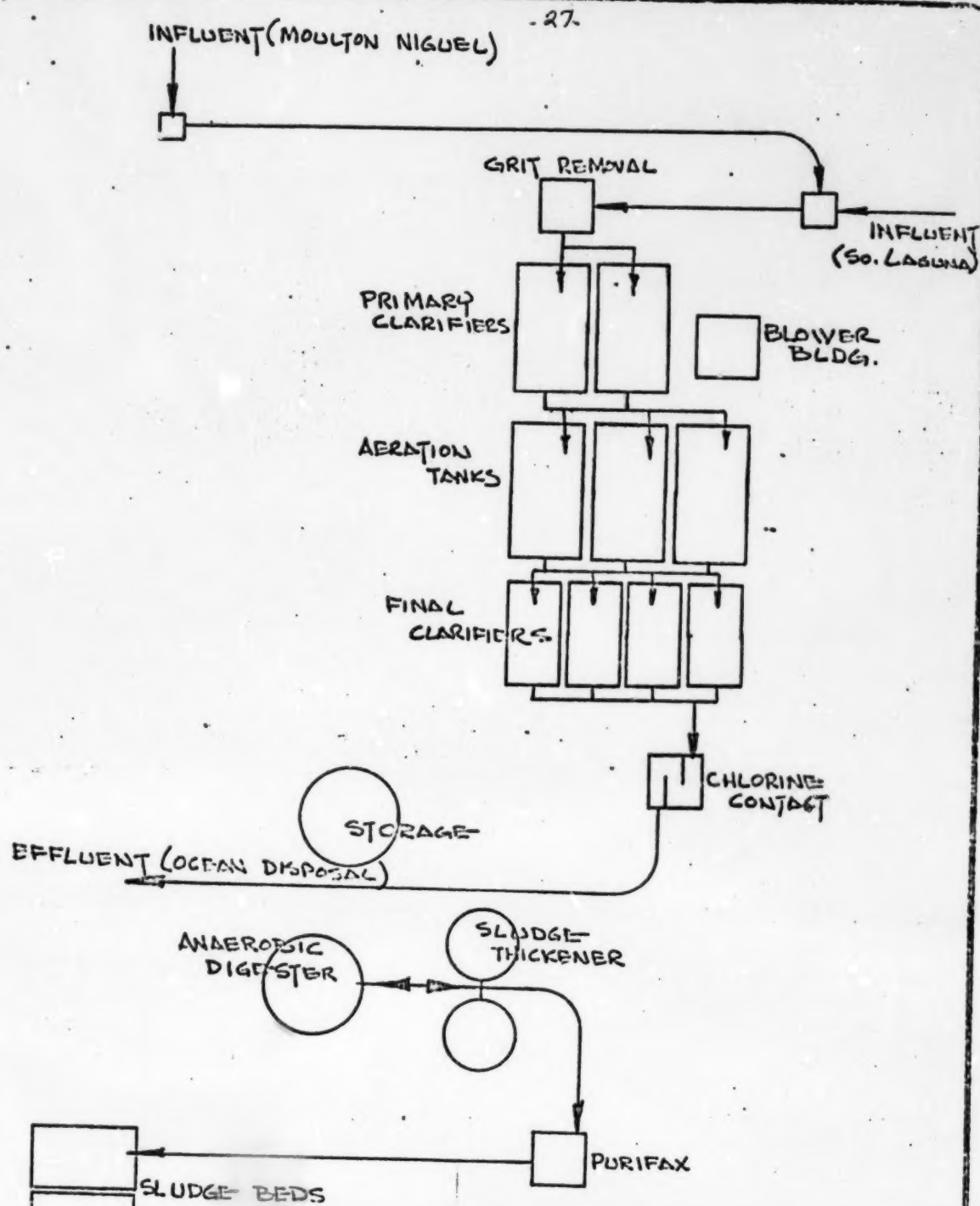
Figure No. 4



Surveillance & Analysis Division
Technical Support Branch

LOS ALAMOS
WATER POLLUTION CONTROL PLANT

Figure No. 5



Surveillance & Analysis Division
Technical Support Branch

SOUTH LAGUNA
WATER QUALITY CONTROL PLANT

Figure No. 6

STATE OF CALIFORNIA—RESOURCES AGENCY

RONALD REAGAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
SAN DIEGO REGION

1350 FRONT STREET, ROOM 2030
SAN DIEGO, CALIFORNIA 92101

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MOULTON-NIGUEL WATER DIST.

November 22, 1972

Mr. Carl Kymla
General Manager
Moulton-Niguel Water District
27231 Aliso Creek Road
Laguna Niguel, California 92677

Dear Mr. Kymla:

During an inspection trip on November 21, 1972, made jointly with Mr. Harlan Schroth of the Orange County Department of Public Health and Mr. Gary Yamamoto of the State Department of Public Health, staff of this Regional Board observed a number of problems associated with the discharge from the Moulton-Niguel Water District's 1-A and 3-A facilities. The main points are summarized below, by facility, for your information.

Moulton-Niguel 1-A

1. Effluent from the treatment plant was of poor quality as observed in the discharge from the chlorine contact tank. The effluent contained large quantities of suspended solids and floating particulates such as grease balls. No effluent was being discharged to the El Niguel Golf Course, and it was not determined whether effluent was being discharged to a storage pond or to the South Laguna Sanitary District.
2. All storage ponds at the treatment plant site were completely full. Overflow to Sulphur Creek was imminent, with ponded water in all ponds being at a level which was within inches of causing overflows to Sulphur Creek. Storage facilities at the El Niguel Golf Course were likewise full with overflow being imminent.
3. Storage facilities at both the treatment plant site and the El Niguel Golf Course are not adequately protected against runoff and flooding as required by the waste discharge requirements. Substantial quantities of runoff had entered both facilities as indicated by erosion scars at the plant site and by a man-made drainage ditch at the golf course which was still contributing a small amount of flow to the golf course reservoir.

Mr. Carl Kymla

November 22, 1972

4. No operating personnel were available at the facility. Plant facilities were obviously in need of operational care which was evidenced not only by the poor quality of effluent, but also the poor "housekeeping" appearance of the units.

Although no discharge was being made to Sulphur Creek at the time of the inspection, it was apparent that such had occurred during the preceding day or so. As you know, the District definitely discharged effluent from the 1-A facility into Sulphur Creek from October 26 through November 6 and possibly through November 20. This violation of waste discharge requirements was not reported to us by the District, but rather was reported to the Regional Board by the State Department of Public Health. Adequate standby equipment should be provided to prevent effluent from being discharged to Sulphur Creek in the future at any time. In addition, both the treatment plant and golf course storage ponds must be protected in such a manner as to prevent runoff from entering the storage facilities.

The representatives from the health departments also informed staff that effluent from the 1-A facility used for golf course irrigation has not met bacteriological requirements, based upon their samples which were all taken after the effluent had been disinfected. Effluent should not be used for golf course irrigation until such time as the District demonstrates that it can produce an effluent which will comply with the bacteriological requirements for golf course irrigation.

Houlton-Niguel 3-A

1. Effluent from the treatment plant was of even poorer quality than from the 1-A plant. The effluent from the chlorine contact tank was laden with suspended solids and was extremely turbid. Visual observation indicated that there was little, if any, improvement over the raw sewage entering the plant.
2. Although the chemist for the District, Mr. Ed Eisen, was at the 3-A plant, no operating personnel were available at the plant. Again, as at the 1-A plant, the 3-A facilities were badly in need of operational attention. Large quantities of grease and other floatables in the chlorine contact tank, sludge deposits in effluent launders, and the very poor quality effluent all indicate the plant is suffering from lack of operational care.
3. The chlorination and flow metering equipment at the plant were broken and not in operating condition. The pump used to convey effluent from the chlorine contact tank to the pressure filters had been disconnected. Undisinfected, unfiltered effluent of a very poor quality was being pumped to the Mission Viejo Golf Course.

Mr. Carl Kymla

-3-

November 22, 1972

4. The storage ponds on the Mission Viejo Golf Course were full, and undisinfected effluent was being discharged from the overflow pipe in the lower storage pond to Oso Creek. Operating personnel, checking on the chlorinators at the lower storage pond, were contacted and requested to stop discharging from the 3-A plant to the storage ponds. Operating personnel made the offhand comment that after three months parts had finally been obtained to repair the chlorinators at the 3-A plant.

Effluent from the 3-A facility obviously does not meet the waste discharge requirements for golf course irrigation. In addition to containing large quantities of suspended material, the health departments have informed staff that effluent used for golf course irrigation does not meet bacteriological requirements, based on their samples which were all taken after chlorination at the golf course. Therefore, no further use of effluent from the 3-A plant should be made for golf course irrigation until the District demonstrates that it can produce an effluent which complies with waste discharge requirements in all respects. Also, should the District be able to improve its operation of the 3-A plant to produce such an effluent, effluent should not be discharged into the golf course storage ponds until a fail-safe method of controlling the flow so that no overflow to Oso Creek will occur is provided. This will in all probability require float controlled valves and/or telemetering equipment.

I realize the foregoing is a brief summary of comments and requests; I will be most happy to meet with you and your staff at any time to provide details or answer questions. I would appreciate a written response at your earliest convenience, though, on all measures that will be taken to rectify the situation.

One last comment. Because of the complexities of the particular plants involved and the controls necessary to assure that the complete interlocked system is functioning properly at all times, in my judgment, it is absolutely necessary to have at least one full-time operator at each of the District's plants seven days per week. Plants need at least as much operating attention, and in my experience more, on weekends as on weekdays. Also, even as far back as 1963, the Public Health Service was recommending that for a 0.5 MGD activated sludge plant at least one full-time operator and one full-time laborer be provided. I believe you'll agree, that even today under more strict regulation, the District falls far short of this goal.

Very truly yours,

Ladine H. Delaney

LADINE H. DELANEY
Senior Engineer

LHD:bcs

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